DATA REPRESENTATION IN A COMPUTER - Computer Studies Form 3 Notes

Introduction

- Computers are classified according to functionality, physical size and purpose.
- When classified according to functionality, computers can be analog, digital or hybrid.
- Digital computers process data that is in discrete form while analog computers process data that is continuous in nature.
- Hybrid computers, on the other hand can process both discrete and continuous data.
- In digital computers, the user input is first converted and transmitted as electrical pulses that can be represented by two distinct digits' l' and '0' before processing.
- These two digits are referred to as binary digits or in short bits.
- Although two graphs can look different in their appearance, they may repeat themselves at equal time intervals.
- Electronic signals or waveforms of this nature are said to be periodic.
- Generally, a periodic wave representing a signal can be described using the following parameters.
    - Amplitude (A)
    - Frequency (f)
    - Periodic time (T)

Amplitude (A)

- Amplitude is the maximum value a wave can attain.
- For example, the amplitude of waves in Figure 1.1 is 1.

Frequency (f):

- Frequency of a wave is the number of cycles made by the wave in one second.

- It is measured in units called hertz (Hz).
- 1Hz is equivalent to 1 cycle/second.

Periodic Time (T):

- The time taken by a signal to complete one cycle is called periodic time.
- Periodic time, T, is given by the formula $T = 1/f$ where f is the frequency of the wave.
- When a digital signal is to be sent over analog telephone lines e.g. e-mail, it has to be converted to analog signal.
- This is done by connecting a device called a modem to the digital computer.
- This process of converting a digital signal to an analog signal is known as modulation.
- On the receiving end, the incoming analog signal is converted back to digital form in a process known as demodulation.

Concepts of Data representation in Digital Computers

- Since digital computers are the most widely used, this notes seeks to explain in details how data is represented in digital form.
- Data and instructions cannot be entered and processed directly into computers using human language.
- Any type of data be it numbers, letters, special symbols, sound or pictures must first be converted into machine readable form i.e. binary form.
- Due to this reason, it is important to understand how a computer together with its peripheral devices handle data in its electronic circuits, on magnetic media arid in optical devices.

Data Representation in Electronic Circuits

- Electronics components, such as the microprocessor, are made up of millions of electronic circuits.
- The availability of a high voltage (on) in these circuits is interpreted as 'I' while a low voltage (off) is interpreted as a '0'.
- This concept can be compared to switching on and off of an electric circuit.
- When the switch is closed, the high voltage in the circuit causes the bulb to light (' l' state).
- On the other hand, when the switch is open, the bulb goes off ('0' state).

Data Representation on Magnetic Media

- The presence of a magnetic field in one direction on magnetic media is interpreted as 'I', while the field in the opposite direction is interpreted as '0'.
- Magnetic technology is mostly used on storage devices which are coated with special magnetic materials such as iron oxide.
- Data is written on the media by arranging the magnetic dipoles of some iron oxide particles to face in the same direction and some others in the opposite direction.
- The figure below shows how data is recorded on the surface of a magnetic disk. Note that the dipoles on the track are arranged in groups facing opposite directions.